Proposed Guidelines for Evaluating Chemical Exposures

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INTRODUCTION

- **Hanford Tank Farms store about 54 million gallons of mixed radioactive waste in 177 underground tanks.**
- **By volume, most of the waste is sodium salts. The sodium salts dominate the toxicity of the waste.**
- **The waste also contains some metals, organic compounds and radionuclides.**

Aerial View of Hanford Tank Farm

Inside a Hanford Underground Tank

Saltcake

Liquid Waste and Crystallized Salt

WASTE COMPOSITION

- **Principal Contributors to toxicity of Hanford Tank Wastes are:**

Solid Phase	**Liquid Phase**
Sodium Nitrite	**Sodium Nitrite**
Sodium Nitrate	**Sodium Hydroxide**
Trisodium Arsenate	**Sodium Nitrate**
Lead Phosphate	**Potassium Nitrite**
Cadmium Oxide	**Sodium Chromate**

REQUIREMENTS FOR SAFETY ANALYSIS

- **10 CFR 830, "Nuclear Safety Management," requires a Safety Analysis Report (SAR) and Technical Safety Requirements (TSRs) for Tank Farms.**

- **The SAR must address both radiological and "non-radiological" (toxicological chemical) hazards.**

REQUIREMENTS FOR SAFETY ANALYSIS - Continued

- **10 CFR 830 is implemented by DOE-STD-3009-94, Change 1.**

- **Appendix A of DOE-STD-3009-94 provides quantitative radiological standard for identifying and developing safety class (SC) systems, structures & components (SSCs).**

REQUIREMENTS FOR SAFETY ANALYSIS - Continued

- **TSRs are sometimes required to protect SSCs, so Appendix A sometimes has indirect effect on identifying TSRs.**

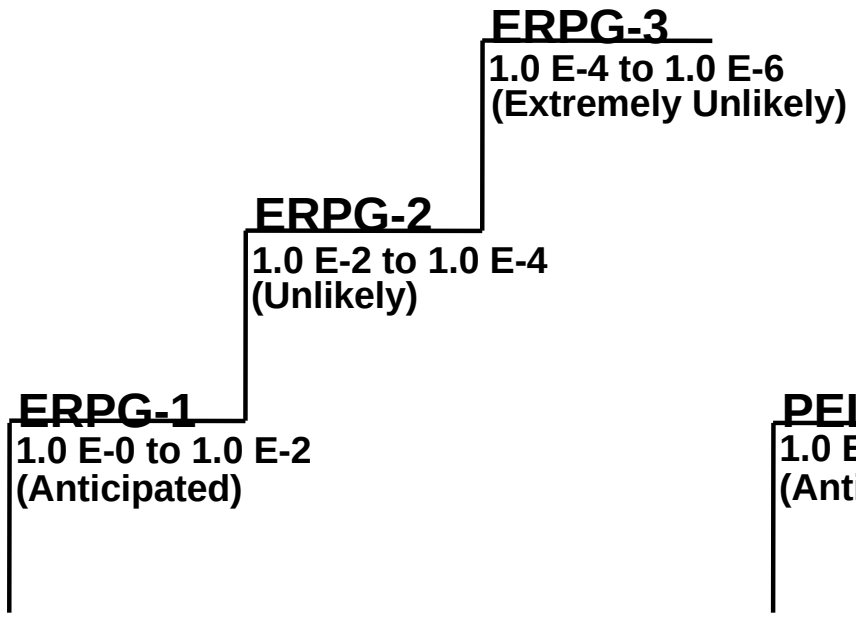
- **No quantitative guidelines are provided for chemical exposures in 10 CFR 830, DOE-STD-3009-94, or their predecessor DOE Order 5480.23.**

CURRENT HANFORD EVALUATION GUIDELINES

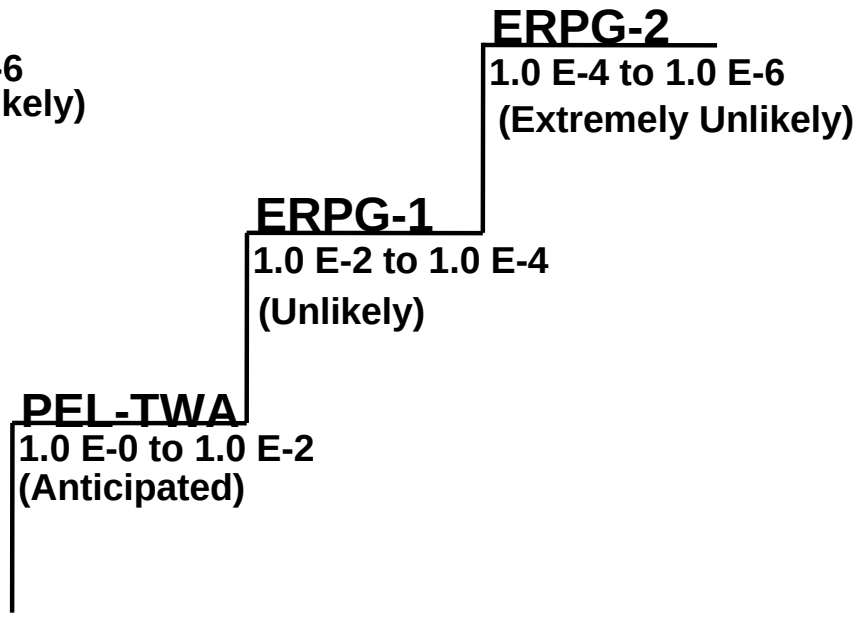
- **Frequency based "stairsteps" are used at Hanford (and several other DOE sites) to evaluate need for SSCs and TSRs.**
- **Separate On-site and off-site "stairsteps" are used.**
- **Emergency Response Planning Guides (ERPGs) and Permissible Exposure Limits/Time Weighted Averages (PEL/JWA) airborne concentration limits are used to quantify exposure.**
- **Temporary Emergency Exposure Limits (TEELs) are used When no ERPGs are available.**
- **Sum of Fractions methodology used to sum effects of a mixture.**

STAIR STEP GUIDELINES

ONSITE GUIDELINES



OFFSITE GUIDELINES



PROBLEM

- **Consequence calculations performed for onsite (100 meter) worker and public.**
- **For some accidents, chemical consequences greater than radiological consequences.**
- **Considering compounds listed, we don't believe this result is reasonable.**
- **Two contributors to this result:**
  - **Permissible concentrations decreasing**
  - **Misuse of toxicological metrics**

EXAMPLE OFF-SITE EXPOSURE

- **Using stairstep for offsite accident with assigned frequency of anticipated consequences should not exceed PEL/TWA values at site boundary.**
- **PEL/TWA is maximum air borne concentration workers can be exposed to 8 hrs/day, 40 hrs/week with no known health effects.**
- **Not reasonable standard to apply to an acute, inhalation exposure on an infrequent basis.**

EXAMPLE ON-SITE EXPOSURE

- **Using stairsteps for onsite accident with assigned frequency of unlikely, accident consequences for the 100 meter worker should not exceed ERPG 2 levels.**
- **ERPG 2 value is maximum airborne concentration that a person con be exposed to for up to 1 hour without permanent ill effects or impairment of person's ability to take protective actions.**
- **Not reasonable standard because not credit is given for emergency measures.**
- **Applying ERPG 2 levels in this situation assumes workers will take no actions to protect themselves.**

RECOMMENDATION

DOE-STD-3009-94:

"The Occupational Safety and Health Administration (OSHA) has recently published 10 (sic) CFR 1910.119, 'Process Safety Management of Highly Hazardous Chemicals.' The purpose of this regulation is defined by OSHA in summary fashion as, **'Employees have been and continue to be exposed to the hazards of toxicity, fires, and explosions from catastrophic releases of highly hazardous chemicals in their workplaces. The requirements in this standard are intended to eliminate or mitigate the consequences of such releases.' Many of the topics requiring coverage in this federal regulation, such as design codes and standards, process hazard analysis, human factors, training, etc., are directly parallel to the topics addressed by DOE 5480.23.**[3] The regulation also provides overall integration of these topics.

The OSHA standard addresses the issue of worker safety from process accidents by **requiring the performance of hazards analyses for processes (exclusive of standard industrial hazards) in conjunction with implementation of basic safety programs that discipline operations and ensure judgments made in hazard analyses are supported by actual operating conditions**. These requirements effectively integrate programs and analyses into an overall safety management structure without requiring quantitative risk assessment. **This integration and the basic concepts of Process Safety Management (PSM) described above are philosophically accepted as appropriate for SARs. This Standard effectively merges PSM principles with traditional nuclear SAR precepts."**

WORKER SAFETY

- **Consequence calculations from the FSAR would not be used to establish TSRs or SSCs for worker safety.**
- **As pointed out in quote from STD-3009-94, guidance provided by 29 CFR 1910.119 for worker protection is compatible with most aspects of DOE Integrated Safety Management System.**
- **SARs require procedures, programs of administrative controls and emergency preparedness programs.**
- **Effective implementation of procedures, emergency preparedness, and OSHA requirements ensures safety of workers – not controls selected on basis of arbitrary risk evaluation guidelines.**

PUBLIC SAFETY

- **EPA requires calculation be performed to determine the distance downwind from the release point at which the concentration has dropped to ERPG-2 levels.**
- **We recommend a guideline that says no concentration that exceeds ERPG-2 levels will pass site boundary.**
- **Guideline would be independent of frequency.**

RECOMMENDATION

- **Adopt and adapt OSHA and EPA guidelines.**
- **29 CFR 1910.119 “Process Safety Management of “Highly Hazardous Chemicals.”**
- **40 CFR 68 “Chemical Accident Prevention Guidelines.”**
- **With appropriate implementation, quantitative guidelines for assessing TSRs and SSCs for use in DOE SARs can be developed.**

RECOMMENDATION - Continued

- **Lists of chemical and threshold values given in 29 CFR 1910.119 and 40 CFR 68 not all-inclusive for DOE sites.**

- **DOE, not EPA, methodology used for consequence calculations.**

CONCLUSION

DOE requires:

- **That risk evaluation guidelines not be used as "speed limits" for making decisions about TSRs and SSCs.**
- **Decisions be made based on consequences form hazards analysis and not frequencies.**
- **Evaluation of accident consequences and strategies for using SSCs, TSRs, and defense in-depth to protect workers and the public.**

CONCLUSION - Continued

- **Evaluation of toxicological hazards in SARs should move toward chemical safety guidelines.**
- **Using guidelines adapted from OSHA and EPA rules will:**
  - **Reduce multiple guidelines used in the complex today.**
  - **Eliminate frequency based guidelines.**
  - **Use standards recognized by other government agencies and the public.**
  - **Put DOE sites on a similar footing with private industry.**